

CLAIMS:

5 1. A method for processing data packets to be transmitted by a cable modem on an upstream channel of a cable transmission system, the method comprising:

sending on the upstream channel a request for an amount of bandwidth to transmit a data packet;

10 receiving a grant of an amount of bandwidth and a transmission time period to transmit data in response to the request;

comparing the requested amount of bandwidth with the granted amount of bandwidth;

15 transmitting the entire data packet on the upstream channel during the transmission time period if the requested amount is no larger than the granted amount;

fragmenting the data packet into a plurality of portions if the requested amount is larger than the granted amount, one of the portions being no larger than the granted amount; and

20 transmitting the one portion that is no larger than the granted amount on the upstream channel during the transmission time period if the requested amount is larger than the granted amount.

25 2. The method of claim 1, in which the data packet to be transmitted has a given total length, the method additionally comprising determining a burdened PHY length from the given total length based on the burden imposed by the transmission format, and the sending step sends a request for the burdened PHY length.

30 3. The method of claim 2, in which the receiving comprises receiving a burdened PHY length and determining the granted amount based on the burden imposed by the transmission format.

35 4. The method of claim 1, additionally comprising if the requested amount is larger than the granted amount:

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5 sending on the upstream channel an additional request for an amount of bandwidth to transmit the remaining portion or portions of the data file;

receiving an additional grant of an amount of bandwidth during an additional transmission time period to transmit data in response to the additional request;

10 comparing the amount of bandwidth of the additional request with the amount of bandwidth of the additional grant;

transmitting the entire remaining portion of the data packet on the upstream channel during the additional transmission time period if the additional requested amount is no larger than the additional granted amount.

15 5. The method of claim 4, additionally comprising:

fragmenting the remaining portion of the data packet into a plurality of additional portions if the additional requested amount is larger than the additional granted amount, one of the additional portions being no larger than the additional granted amount; and

20 transmitting the one additional portion on the upstream channel during the additional transmission time period if the additional requested amount is larger than the additional granted amount.

25 6. The method of claim 4, in which sending an additional request comprises transmitting the additional request with the one segment in piggyback fashion on the upstream channel.

30 7. The method of claim 6, in which the additional request and the one segment with which the additional request is transmitted are encapsulated together in a PDU packet having a header that signals the presence of the additional request.

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8. The method of claim 1, in which the grant is received in one of a plurality of MAP messages, the method additionally comprising if the requested amount is larger than the granted amount:

after receiving the grant, checking the one MAP for an additional grant or a grant pending; and

10 sending on the upstream channel an additional request for an amount of bandwidth to transmit the remaining segment or segments of the data file if the one MAP contains no additional grant or grant pending.

15 9. The method of claim 8, in which sending an additional request comprises transmitting the additional request with the one segment in piggyback fashion on the upstream channel.

20 10. The method of claim 9, in which the additional request and the one segment with which the additional request is transmitted are encapsulated together in a PDU packet having a header that signals the presence of the additional request.

11. The method of claim 9, additionally comprising if the one MAP contains an additional grant:

25 receiving in the additional grant a granted amount of bandwidth and a transmission time period to transmit data;

comparing the additional requested amount of bandwidth with the additional granted amount of bandwidth;

30 transmitting the entire data file on the upstream channel during the transmission time period if the additional requested amount is no larger than the additional granted amount;

35 fragmenting the data file into a plurality of segments if the additional requested amount is larger than the additional granted amount, one of the segments being no larger than the additional granted amount; and

transmitting the one segment on the upstream channel during  
the transmission time period if the additional requested amount is  
5 larger than the granted amount.

12. The method of claim 1, in which data packets to be  
transmitted on the cable system are stored in a queue, the method  
additionally comprising if the requested amount is no larger than  
10 the granted amount:

checking the queue for data packets to be transmitted;

15 sending on the upstream channel an additional request for an  
amount of bandwidth and transmission time period to transmit one of  
the data packets in the queue.

13. The method of claim 12, in which sending an additional  
request comprises transmitting the additional request with the one  
segment in piggyback fashion on the upstream channel.

20 14. The method of claim 13, in which the additional request  
and the one segment with which the additional request is  
transmitted are encapsulated together in a PDU packet having a  
header that signals the presence of the additional request.

25 15. The method of claim 1, additionally comprising receiving  
request acknowledgments, setting a timer each time a request is  
sent, and resending the request after the timer expires if no  
acknowledgment has been received.

30 16. The method of claim 15, additionally comprising repeating  
the receiving, setting, and resending steps recited in claim 22a,  
counting the times the request is resent, discarding the data  
packet without upstream transmission and terminating the repeating  
step if the request is resent a predetermined number of times.

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17. A cable modem for operating with a cable transmission system comprising:

5 means for requesting an amount of bandwidth on the cable system to transmit data;

means for receiving a grant of an amount of bandwidth to transmit data in response to the request;

10 means for comparing the requested amount of bandwidth with the granted amount of bandwidth;

means responsive to the comparing means for fragmenting the data to be transmitted into a plurality of segments if the requested amount is larger than the granted amount, one of the segments being no larger than the granted amount;

15 means responsive to the grant for transmitting the data to be transmitted to the cable system if the requested amount is no larger than the granted amount; and

20 means responsive to the grant for transmitting the one segment that is no larger than the granted amount to the cable system if the requested amount is larger than the granted amount.

25 18. The cable modem of claim 17, additionally comprising means responsive to one or more subsequent grants for sequentially transmitting the remaining segment or segments to the cable system if the requested amount is larger than the granted amount.

30 19. The cable modem of claim 17, additionally comprising means for transmitting with the one segment an additional request for an amount of bandwidth sufficient to transmit the remaining segments.

20. The cable modem of claim 19, additionally comprising means for receiving an additional grant of an amount of bandwidth to transmit data in response to the additional request;

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means for additionally comparing the additionally requested amount of bandwidth with the additionally granted amount of bandwidth;

means responsive to the additional comparing means for fragmenting the data to be transmitted into a plurality of additional segments if the additionally requested amount is larger than the additionally granted amount, one of the segments being no larger than the additionally granted amount;

means responsive to the additional grant for transmitting the data to be transmitted to the cable system if the additionally requested amount is no larger than the additionally granted amount; and

means responsive to the additional grant for transmitting the additional one segment to the cable system if the additional requested amount is larger than the additional granted amount.

21. The cable modem of claim 17, additionally comprising means for transmitting with the one segment an additional request in a piggyback field for an amount of bandwidth sufficient to transmit the remaining segments.

22. The cable modem of claim 21, in which the grant receiving means is capable of receiving an original grant, one or more additional grants, and/or one or more pending grants in the same MAP, the cable modem additionally comprising:

means for sensing the presence of additional grants or pending grants in said MAP; and

means for setting the piggyback field to zero when the presence of additional grants or pending grants is sensed in said MAP to prevent transmission of any additional requests.

23. The cable modem of claim 17, in which the requesting means takes overhead into account in the amount of bandwidth.

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24. The cable modem of claim 23, in which the fragmenting means takes overhead into account in the one segment.

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25. A bi-directional data distribution system, comprising:  
a headend for distributing downstream data downloads to a plurality of end users;

10 a time slot allocation controller for allocating user specific TDMA time slots in response to transmittal requests received for data to be transmitted by the end users; and

15 a plurality of cable modems, each of said plurality of cable modems associated with a specific end user for selectively transmitting data upstream to said headend from said specific end user in accordance with said time slot allocation data, each of said cable modems automatically fragmenting the data being transmitted if necessary to fit within the allocated TDMA time slot.

20 26. The system of claim 25, wherein each of said plurality of cable modems further comprises a data transmittal request generator for requesting an additional time slot allocation for later transmission of any remainder data not transmitted within the allotted time slot as a result of fragmenting the data.

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27. The system of claim 25, wherein each of said plurality of cable modems further comprises a data transmittal request generator for inserting a request for an additional time slot with one portion of fragmented data a previous time slot for later  
30 transmission of additional portions of the fragmented data.

28. A bi-directional cable modem for use in an asymmetrical TDMA data distribution system, comprising:  
a downstream data receiver;

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a data transmittal request generator for sending requests to transmit data upstream; and

5 a data fragmenting circuit responsive to TDMA time slot allocation instructions for fragmenting the data being transmitted necessary to fit within an allocated time slot.

10 - 29. A series of data fragments for transmitting a single data packet on an upstream channel of a cable transmission system in fragmented form, each data fragment comprising:

a header portion that signals a fragmented data packet;

a payload portion that carries only part of the data packet;

and

15 a fragment sequence count that identifies the order of the payload portion in the data packet.

20 30. The series of data fragments of claim 29, additionally comprising an extended header portion in a penultimate data fragment that identifies a piggyback request for bandwidth.

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